Alexander & Sadiku Practive Problem 10.1
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> *restart*

Handy functions for dealing with phasors

> $j := I$

$$j := \mathrm{I} \tag{1}$$

> $polard := (mag, angd) \rightarrow \mathrm{polar}(mag, angd * \mathrm{Pi} / 180)$

$$polard := (mag, angd) \rightarrow \mathrm{polar}\left(mag, \frac{1}{180}\, angd\, \pi\right) \tag{2}$$

> $argumentd := (num) \rightarrow \mathrm{argument}(num) * 180 / \mathrm{Pi}$

$$argumentd := num \rightarrow \frac{180\, \mathrm{argument}(num)}{\pi} \tag{3}$$

> *listphasors* := **proc**(*plist*) **local** *k*
for *k* **from** 1 **to** *nops*(*plist*[ ]) **do**
printf("%s = %f < %f deg\n", *lhs*(*plist*[ ][*k*]), *evalf*(abs(*rhs*(*plist*[ ][*k*]))),
evalf(*argumentd*(*rhs*(*plist*[ ][*k*]))))
end do end proc:

Circuit equations

> $KCLn1 := -Ia + \frac{(V1 - 0)}{R1} + (V1 - V2) \cdot j \cdot \mathrm{omega} \cdot C = 0$

$$KCLn1 := -Ia + \frac{V1}{R1} + \mathrm{I}\,(V1 - V2)\,\omega\, C = 0 \tag{4}$$

> $KCLn2 := (V2 - V1) \cdot j \cdot \mathrm{omega} \cdot C + \frac{(V2 - 0)}{j \cdot \mathrm{omega} \cdot L} + \frac{(V2 - b \cdot Vx)}{R2} = 0$

$$KCLn2 := \mathrm{I}\,(V2 - V1)\,\omega\, C - \frac{\mathrm{I}\, V2}{\omega\, L} + \frac{V2 - b\, Vx}{R2} = 0 \tag{5}$$

> $CTRL := Vx = \mathrm{V1}$

$$CTRL := Vx = V1 \tag{6}$$

Solve circuit equations

> $MySoln := solve(\{KCLn1, KCLn2, CTRL\}, [V1, V2, Vx])$

$$MySoln := \left[\left[V1 = \frac{\mathrm{I}\, R1\, \left(\mathrm{I}\,\omega^2\, C\, L\, R2 - \mathrm{I}\, R2 + \omega\, L\right)\, Ia}{-\omega^2\, C\, L\, R2 + R2 + \mathrm{I}\, R2\, \omega\, C\, R1 + \mathrm{I}\,\omega\, L - \omega^2\, L\, C\, R1 + \omega^2\, L\, b\, C\, R1},\right.\right. \tag{7}$$

$$V2 = -\frac{Ia\, L\, \omega\, R1\, (\omega\, C\, R2 - \mathrm{I}\, b)}{-\omega^2\, C\, L\, R2 + R2 + \mathrm{I}\, R2\, \omega\, C\, R1 + \mathrm{I}\,\omega\, L - \omega^2\, L\, C\, R1 + \omega^2\, L\, b\, C\, R1}, Vx$$

$$\left.\left. = \frac{\mathrm{I}\, R1\, \left(\mathrm{I}\,\omega^2\, C\, L\, R2 - \mathrm{I}\, R2 + \omega\, L\right)\, Ia}{-\omega^2\, C\, L\, R2 + R2 + \mathrm{I}\, R2\, \omega\, C\, R1 + \mathrm{I}\,\omega\, L - \omega^2\, L\, C\, R1 + \omega^2\, L\, b\, C\, R1}\right]\right]$$

Define lists for known values

> $Vals := R1 = 2, R2 = 4, L = 2, C = 0.2, \mathrm{omega} = 2, Ia = polard(10, 0), b = 3$

$$Vals := R1 = 2, R2 = 4, L = 2, C = 0.2, \omega = 2, Ia = \mathrm{polar}(10, 0), b = 3 \tag{8}$$

Find numerical solutions

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> MySoln := subs(Vals, MySoln)
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$$MySoln := [[V1 = (0.5660377358 + 0.9811320755\,\mathrm{I})\ \mathrm{polar}(10,\ 0),\ V2 = (1.792452830 + 2.773584906\,\mathrm{I})\ \mathrm{polar}(10,\ 0),\ Vx = (0.5660377358 + 0.9811320755\,\mathrm{I})\ \mathrm{polar}(10,\ 0)]] \quad \textbf{(9)}$$

Find phasors

```
> listphasors(MySoln)
V1 = 11.327042 < 60.018361 deg
V2 = 33.023719 < 57.127091 deg
Vx = 11.327042 < 60.018361 deg
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Conclusion: v1(t) = vx(t) = 11.327 cos(2 t + 60.01 deg), v2(t) = 33.02 cos(2 t + 57.13 deg)